DEPARTMENT OF THE NAVY
BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
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SAN DIEGO, CA 92147

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Ser BPMOW.gc/0371
October 26, 2017

Mr. Michael R. Markus, PE, DWRE, BCEE, FASCE
General Manager
Orange County Water District
10500 Ellis Avenue, P.O. Box 8300
Fountain Valley, CA 92708-8300

Mr. Paul A. Cook
General Manager
Irvine Ranch Water District
15600 Sand Canyon Avenue
Irvine, CA 92618

Dear Messrs. Markus and Cook:

SUBJECT: NOTIFICATION REGARDING PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) DETECTIONS IN EXTRACTED GROUNDWATER AT INSTALLATION RESTORATION PROGRAM (IRP) SITES 18 AND 24 FORMER MARINE CORPS AIR STATION (MCAS) EL TORO, IRVINE, CALIFORNIA

In accordance with Section III.A.4.b.i of the *Settlement Agreement Among the Settling Federal Agencies, Orange County Water District, and Irvine Ranch Water District in Regard to Former Marine Corps Air Station El Toro Groundwater Remediation* (the "Agreement") executed in 2001, the U.S. Department of the Navy (Navy) is providing this notice of recent detections of PFAS compounds in groundwater extracted from the Principal Aquifer (PA) at IRP Site 18 and the Shallow Groundwater Unit (SGU) at IRP Site 24. Per the terms of the Agreement, Orange County Water District (OCWD) and Irvine Ranch Water District (IRWD) are responsible for treating trichloroethene (TCE)-impacted PA and SGU groundwater extracted from IRP Sites 18 and 24, respectively. Once treated via air stripping and vapor-phase granular activated carbon, PA groundwater is provided as recycled water to local customers and SGU groundwater is discharged to the South Orange County Wastewater Authority brine line and eventually the Pacific Ocean. This notice to OCWD and IRWD is required by the Agreement because PFAS compounds are not listed in Appendix 3 (Known Analytes Detected in On-Base and Off-Base Groundwater Wells) of the Agreement.

Background

PFAS are a class of man-made chemicals found in many consumer products such as stain-resistant textiles, nonstick cookware, cleaning products, and cosmetics. In military applications, various PFAS compounds, including perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic

acid (PFOA), were used in aqueous film-forming foam (AFFF), which was historically used for firefighting in response to aircraft crashes. AFFF was also used in firefighting equipment testing and training. More information can be found on the Navy's PFAS website at http://www.secnav.navy.mil/eie/pages/pfc-pfas.aspx.

PFAS have been identified as emerging contaminants by the United States Environmental Protection Agency (U.S. EPA). In May 2016, U.S. EPA issued lifetime health advisories (LHAs) for long-term exposures to PFOA and PFOS through drinking water. The LHAs are 70 parts per trillion (ppt) for individual or combined concentrations of PFOA and PFOS. U.S. EPA recently updated its risk-based regional screening level (RSL) for perfluorobutanesulfonic acid (PFBS) from 380,000 to 400,000 ppt. It is important to note that these federal LHAs and RSL are non-promulgated criteria and not legally enforceable. No State of California screening criteria have been established for any PFAS compounds.

Local Drinking Water is Not Impacted

In 2013 and 2014 as part of compliance with U.S. EPA's Third Unregulated Contaminant Monitoring Rule, IRWD and OCWD collected a number of water samples within their potable water distribution systems and analyzed them for six PFAS compounds (including PFOS, PFOA, and PFBS) via U.S. EPA Method 537. There were no PFAS detections, and method reporting limits were less than the non-promulgated federal screening criteria cited above. These data confirm that potable water supplied to residents in the vicinity of Former MCAS El Toro does not contain PFAS at concentrations of concern.

Previous PFAS Notifications from OCWD

On September 1, 2016, I received an email from Mr. Roy Herndon, Chief Hydrogeologist, OCWD, transmitting the results of two samples (July 28 and August 9, 2016) of influent groundwater to the SGU Treatment Plant that were analyzed for six PFAS compounds, including PFOS, PFOA, and PFBS. PFOS and PFOA were detected at similar concentrations during both sampling events, averaging approximately 395 and 240 ppt, respectively. These concentrations are individually and collectively greater than U.S. EPA's LHA of 70 ppt. PFBS was detected at an average concentration of 93.5 ppt, several orders of magnitude less than the RSL of 400,000 ppt.

Mr. Herndon subsequently transmitted the results from PFAS analysis of PA groundwater from extraction well ET-1, both before and after treatment via air stripping at the PA Treatment Plant (October 19, 2016). PFOS and PFOA were detected in the raw groundwater at concentrations of 38.2 and 227 ppt, respectively. Since air stripping is not effective at removing PFAS compounds from groundwater, it was not surprising to see similar PFOS and PFOA concentrations in the treated groundwater (35.8 and 233 ppt, respectively). PFBS was detected in both the raw and treated groundwater at concentrations of approximately 7 ppt.

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Initial Basewide Groundwater Assessment for PFAS

The Navy recently voluntarily and proactively implemented the *Final Sampling and Analysis Plan for Initial Basewide Assessment of PFAS in Groundwater*, which had been reviewed and approved by U.S. EPA, California Department of Toxic Substances Control, and California Regional Water Quality Control Board, Santa Ana Region (Multi-Media Environmental Compliance Group, 2017). Based on previous military activities that may have involved the use of PFAS-containing materials such as AFFF, IRP Sites 1, 2, 5, 9, 16, 18, and 24 were identified as potential sources of PFAS in groundwater. Representative monitoring wells and other sampling locations (e.g., SGU Transfer Station effluent) were selected within and in proximity to these IRP sites to assess the presence or absence of PFAS in groundwater. A total of 22 primary and 3 duplicate groundwater samples were collected in July 2017 and analyzed for PFOA, PFOS, and PFBS in addition to 11 other PFAS compounds via U.S. EPA Method 537 modified.

Results indicate the presence of PFOS and/or PFOA in groundwater associated with IRP Sites 1, 18, and 24 at concentrations greater than U.S. EPA's LHA. PFOS and PFOA are not present in groundwater associated with IRP Sites 2, 5, 9, and 16 at concentrations greater than U.S. EPA's LHA. While PFBS was detected at every IRP site, none of the concentrations was greater than the RSL. It is interesting to note that the Navy obtained almost identical results as to those obtained by OCWD for the SGU Transfer Station effluent (influent to the SGU Treatment Plant). Primary and duplicate samples were collected and analyzed from this location. PFOS and PFOA were detected at approximate average concentrations of 401 and 233 ppt, respectively. PFBS was detected at an approximate average concentration of 78 ppt.

The Navy is currently preparing and will provide your colleagues (Messrs. Herndon [OCWD] and Kalinsky [IRWD]) with a copy of a report documenting the results. In the meantime, please refer to Enclosure 1 for a table summarizing the results and Enclosures 2 through 4 for depictions of the sampling locations at IRP Sites 1, 18, and 24 where LHA exceedances were observed. Please note that the Navy provided a general informal verbal notification of these results to IRWD and OCWD during an August 8, 2017 meeting at the IRWD Operations Center regarding the IRP Site 18 groundwater modeling efforts.

Next Steps

Section III.A.4.b.ii of the Agreement stipulates that within 7 calendar days of this notification, the parties to the Agreement and Federal Facility Agreement (FFA) representatives shall determine whether the SGU and/or PA Treatment Plants can continue to adequately treat extracted groundwater to ensure compliance with applicable federal and state water quality standards, or in the absence of such standards, ensure the treated groundwater poses no potential health threat to the public. Based on the following facts, the Navy's position is that both the SGU and PA Treatment Plants can continue operations without modifications at this time. First, PFAS

compounds have not been detected in OCWD's and IRWD's sampling of the potable water supply (see above). Second, neither treated PA nor SGU groundwater are provided to the public for potable purposes. Third, there are no legally enforceable human-health-based (or ecological-health-based) water quality standards for PFAS compounds.

However, considering that human- and ecological-health-based PFAS water quality standards are likely to be developed in the future, OCWD and IRWD, in coordination with the Navy, should evaluate the feasibility of modifying the SGU and PA Treatment Plants to address PFAS compounds. The Navy has previously recommended switching the treatment method from air stripping to liquid-phase granular activated carbon as this change would be expected to reduce total lifecycle operating costs and environmental impacts (e.g., energy use). The Navy is aware that IRWD has previously evaluated this modification as part of the *Cost Analysis of Liquid Phase Granular Activated Carbon Treatment, Shallow Groundwater Unit and Principal Aquifer Plant Treatment* (Tetra Tech, Inc., 2012), but decided not to pursue it.

The Navy recommends that the parties to the Agreement and FFA representatives convene during a conference call over the next few weeks to discuss this matter. I will be contacting Messrs. Herndon (OCWD) and Kalinsky (IRWD) and the FFA representatives to determine a mutually agreeable day and time.

Thank you for your attention to this matter. If you have any questions or would like to discuss further, I can be reached at (619) 524-4610 or marc.smits@navy.mil.

Sincerely,

MARC P. SMITS
BRAC Environmental Coordinator
By direction of the Director

Enclosure: 1. PFOA, PFOS, and PFBS Results
2. PFOA, PFOS, and PFBS in Groundwater, IRP Site 1
3. PFOA, PFOS, and PFBS in Groundwater in the Shallow Groundwater Unit, IRP Sites 9 and 24
4. PFOA, PFOS, and PFBS in Groundwater in the Principal Aquifer, IRP Site 18

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Enclosure 1
Groundwater Analysis - PFOA, PFOS, and PFBS Results

	Screened Interval	Sample Date	PFOA	PFOS	PFOA + PFOS	PFBS
			µg/L			
		Screening Criterion	**0.07** [1]	**0.07** [1]	**0.07** [1]	**400** [2]
IRP Site 1						
01-PZ20	40-70	7/11/2017	0.00568 U	0.00568 U	0.0114 U	0.00568 UJ
DUP01 (Parent: 01-PZ20)	40-70	7/11/2017	0.00521 U	0.00521 U	0.0104 U	0.00521 UJ
01-MW204	24-54	7/11/2017	**0.00938**	**0.0232**	**0.0326**	**0.0196 J**
01-MW209	25-45	7/11/2017	**0.0622**	**0.333**	**0.395**	**0.0900 J**
01-MW206	17-47	7/11/2017	0.00517 U	0.00517 U	0.0103 U	0.00517 UJ
IRP Site 2						
02DGMW59	69-89	7/11/2017	**0.0318**	**0.0116**	**0.0434**	**0.0116 J**
02NEW16	25-65	7/11/2017	**0.00767 J**	**0.00292 J**	**0.0106 J**	**0.00974**
IRP Site 5						
05_DGMW68A	149-189	7/11/2017	**0.0265**	**0.00754 J**	**0.0340 J**	**0.00404 J**
05_DGMW41B	160-190	7/12/2017	**0.0278**	**0.00413 J**	**0.0319 J**	**0.00419 J**
IRP Sites 9 and 24 (SGU)						
24IN03	140-160	7/12/2017	**0.0403**	0.00534 U	**0.0456**	**0.00897**
DUP02 (Parent: 24IN03)	140-160	7/12/2017	**0.0427**	0.00530 U	**0.0480**	**0.00966**
24MW08B	160-170	7/10/2017	**0.0304**	**0.00158 J**	**0.0320 J**	**0.0108**
24EX13A	145-165	7/12/2017	**0.0776**	**0.00188 J**	**0.0795 J**	**0.200**
24MW15D	220-230	7/12/2017	**0.141**	0.00525 U	**0.146**	**0.0374**
24EX11	195-215	7/10/2017	**2.600**	**0.126**	**2.73**	**0.0649 J**
SGU Transfer Station	N/A; effluent sample	7/10/2017	**0.234**	**0.395 J**	**0.629 J**	**0.0760 J**
DUP03 (Parent: SGU Transfer Station)	N/A; effluent sample	7/10/2017	**0.232**	**0.407**	**0.639**	**0.0805**
IRP Site 18 (PA)						
18BGMW03E	124-164	7/12/2017	**0.00353 J**	0.00530 U	**0.00883 J**	0.00530 U
18MCAS03-2	160-170	7/10/2017	**3.720**	**0.106**	**3.83**	**0.0573**

Enclosure 1
Groundwater Analysis - PFOA, PFOS, and PFBS Results

	Screened Interval	Sample Date	PFOA	PFOS	PFOA + PFOS	PFBS
			µg/L			
		Screening Criterion	**0.07** [1]	**0.07** [1]	**0.07** [1]	**400** [2]
IRP Site 18 (PA) (cont.)						
18MCAS07-3	350-360	7/10/2017	**0.0812**	**0.0203**	**0.102**	**0.00235 J**
18MCAS02-5	420-430	7/10/2017	**0.0151**	**0.00791 J**	**0.0230 J**	0.00517 UJ
18MCAS03-5	420-430	7/10/2017	**0.0348**	**0.0149**	**0.0497**	**0.00482 J**
IRP Site 16						
16_MW19	193-203	7/12/2017	0.00525 U	**0.00221 J**	**0.00746 J**	**0.163**
16_MW04	155-190	7/13/2017	0.00521 U	0.00521 U	0.0104 U	**3.280**
16_MW28	170-195	7/12/2017	0.00525 U	0.00525 U	0.0105 U	**0.149**

Notes:

1. Fact Sheet: PFOA and PFOS Drinking Water Health Advisories. November 2016 (U.S. EPA, 2016)

2. Regional Screening Levels. June 2017. https://www.epa.gov/risk/regional-screening-levels-rsls-users-guide-june-2017 (U.S. EPA, 2017b)

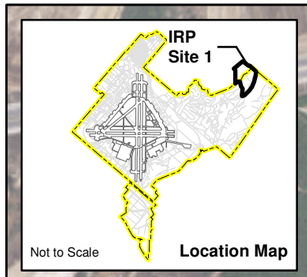
Grey highlight indicates screening criterion exceeded

Bold = detection

µg/L = micrograms per liter; IRP = Installation Restoration Program; N/A = not applicable; PA = Principal Aquifer; PFOA = perfluorooctanoic acid; PFOS = perfluorobutanesulfonic acid; PFBS = perfluorooctane sulfonate; SGU = Shallow Groundwater Unit; ; U.S. EPA = United States Environmental Protection Agency

Data Qualifiers (where appropriate):

J = Estimated value; U = Not detected at or above the reporting limit; UJ = Not detected at or above the estimated reporting limit



Adjacent Property

Northern EOD Training Range

EOD Training Range Buffer Zone

Southern EOD Training Range

Approximate Location of Naphthalene-Impacted Soil

Former Building 795

01-MW204
01-MW209
01-PZ20
01-MW206

01-MW204	
PFOA	**0.00938**
PFOS	**0.0232**
PFOA + PFOS	**0.0326**
PFBS	**0.0196 J**

01-MW209	
PFOA	**0.0622**
PFOS	**0.333**
PFOA + PFOS	**0.395**
PFBS	**0.0900 J**

01-PZ20		
PFOA	0.00568 U	0.00521 U (FD)
PFOS	0.00568 U	0.00521 U (FD)
PFOA + PFOS	0.0114 U	0.0104 U (FD)
PFBS	0.00568 UJ	0.00521 UJ (FD)

01-MW206	
PFOA	0.00517 U
PFOS	0.00517 U
PFOA + PFOS	0.0103 U
PFBS	0.00517 UJ

Legend

- Former MCAS El Toro Boundary
- IRP Site 1 Boundary
- Perimeter Fence
- EOD Training Range Boundary
- Ephemeral Pond
- Stream or Wash (intermittent)
- Groundwater Monitoring Well
- Approximate Groundwater Gradient Direction (2015)*
- Estimated Extent of Perchlorate Concentration in Groundwater Exceeding 6 µg/L (2016)*

Screening Criteria	
PFOA	0.07
PFOS	0.07
PFOA + PFOS	0.07
PFBS	400

Notes:
Results and screening criteria in µg/L
Bold = detection
Exceeds screening criterion
µg/L = micrograms per liter
FD = field duplicate
IRP = Installation Restoration Program
J = estimated concentration
MCAS = Marine Corps Air Station
PFBS = perfluorooctane sulfonate
PFOA = perfluorooctanoic acid
PFOS = perfluorobutanesulfonic acid
U = not detected at or above the reporting limit
UJ = not detected at or above the estimated reporting limit

*Source: AECOM-Envirocon JV, August 2016. Draft Annual Monitoring Report May 2014 - June 2015, Groundwater Remedies at Installation Restoration Program Sites 1 and 2.

Image Source: ESRI ArcGIS Online Web Service 2017

N

0 600 Feet

1 inch = 600 feet

PROJECT NO.:	5026-16-7008
DATE:	October 2017
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Multi-Media Environmental Compliance Group

Former Marine Corps Air Station El Toro, California

PFOA, PFOS, and PFBS in Groundwater IRP Site 1

Enclosure 2

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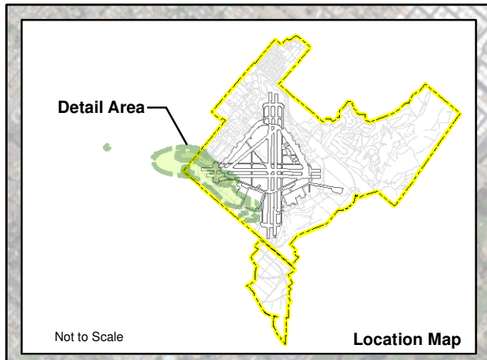

Legend

- Former MCAS El Toro Boundary
- IRP Site 9 Boundary
- Groundwater Monitoring Well (SGU)
- Approximate Groundwater Gradient Direction (2015)*

IRP Site 24 Boundary:

TCE Concentration in Groundwater (March 2016)*

- >50 micrograms per liter
- >5 micrograms per liter

Screening Criteria	
PFOA	0.07
PFOS	0.07
PFOA + PFOS	0.07
PFBS	400

24MW15D	
PFOA	**0.141**
PFOS	0.00525 U
PFOA + PFOS	**0.146**
PFBS	**0.0374**

18MCAS03-2	
PFOA	**3.720**
PFOS	**0.106**
PFOA + PFOS	**3.83**
PFBS	**0.0573**

24EX11	
PFOA	**2.600**
PFOS	**0.126**
PFOA + PFOS	**2.73**
PFBS	**0.0649 J**

24EX13A	
PFOA	**0.0776**
PFOS	**0.00188 J**
PFOA + PFOS	**0.0795 J**
PFBS	**0.200**

24IN03		
PFOA	**0.0403**	**0.0427 (FD)**
PFOS	0.00534 U	0.00530 U (FD)
PFOA + PFOS	**0.0456**	**0.0480 (FD)**
PFBS	**0.00897**	**0.00966 (FD)**

SGU Transfer Station		
PFOA	**0.234**	**0.232 (FD)**
PFOS	**0.395 J**	**0.407 (FD)**
PFOA + PFOS	**0.629 J**	**0.639 (FD)**
PFBS	**0.0760 J**	**0.0805 (FD)**

24MW08B	
PFOA	**0.0304**
PFOS	**0.00158 J**
PFOA + PFOS	**0.0320 J**
PFBS	**0.0108**

18BGMW03E	
PFOA	**0.00353 J**
PFOS	0.00530 U
PFOA + PFOS	**0.00883 J**
PFBS	0.00530 U

IRP Site 24

24MW15D

18MCAS03-2

24EX11

IRP Site 24

IRP Site 9

24EX13A

24MW08B

24IN03

Hangar Buildings

18BGMW03E

SGU Transfer Station

IRP Site 24

Notes:
Results and screening criteria in µg/L
Bold = detection
Exceeds screening criterion
µg/L = micrograms per liter
FD = field duplicate
IRP = Installation Restoration Program
J = estimated concentration
MCAS = Marine Corps Air Station
PFBS = perfluorooctane sulfonate
PFOA = perfluorooctanoic acid
PFOS = perfluorobutanesulfonic acid
U = not detected at or above the reporting limit
SGU = Shallow Groundwater Unit
TCE = trichloroethene

*IRP Site 24 boundary is equal to the extent of TCE in groundwater greater than 5 micrograms per liter in the SGU. Source of TCE groundwater plumes and groundwater gradient direction: Noreas, 2016. Semiannual Groundwater Monitoring and System Operations Data Package, IRP Sites 18 and 24 Groundwater Remedy, January - June 2016, Event 31.

Image Source: ESRI ArcGIS Online Web Service 2017

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0 1,500 3,000 Feet

1 inch = 1,500 feet

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PFOA, PFOS, and PFBS in Groundwater in the Shallow Groundwater Unit, IRP Sites 9 and 24

Enclosure 3

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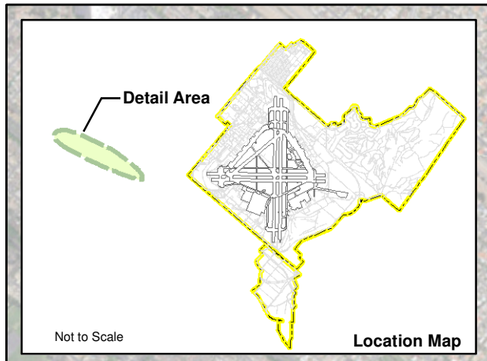

18MCAS07-3

IRP Site 18

18MCAS07-3	
PFOA	**0.0812**
PFOS	**0.0203**
PFOA + PFOS	**0.102**
PFBS	**0.00235 J**

18MCAS03-5	
PFOA	**0.0348**
PFOS	**0.0149**
PFOA + PFOS	**0.0497**
PFBS	**0.00482 J**

18MCAS03-5

18MCAS02-5

18MCAS02-5	
PFOA	**0.0151**
PFOS	**0.00791 J**
PFOA + PFOS	**0.0230 J**
PFBS	0.00517 UJ

Hangar Buildings

Legend

- Former MCAS El Toro Boundary
- Groundwater Monitoring Well (PA)
- Approximate Groundwater Gradient Direction (2015)*

IRP Site 18 Boundary:

TCE Concentration in Groundwater (March 2016)*

- >5 micrograms per liter

Screening Criteria	
PFOA	0.07
PFOS	0.07
PFOA + PFOS	0.07
PFBS	400

Notes:
Results and screening criteria in µg/L
Bold = detection
Exceeds screening criterion
µg/L = micrograms per liter
IRP = Installation Restoration Program
J = estimated concentration
MCAS = Marine Corps Air Station
PA = Principal Aquifer
PFBS = perfluorooctane sulfonate
PFOA = perfluorooctanoic acid
PFOS = perfluorobutanesulfonic acid
TCE = trichloroethene
U = not detected at or above the reporting limit
UJ = not detected at or above the estimated reporting limit

*IRP Site 18 boundary is equal to the extent of TCE in groundwater greater than 5 micrograms per liter in the PA. Source of TCE groundwater plumes: Noreas, 2016. Semiannual Groundwater Monitoring and System Operations Data Package, IRP Sites 18 and 24 Groundwater Remedy, January - June 2016, Event 31.

Image Source: ESRI ArcGIS Online Web Service 2017

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0 1,500 3,000 Feet

1 inch = 1,500 feet

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Former Marine Corps Air Station El Toro, California

PFOA, PFOS, and PFBS in Groundwater in the Principal Aquifer, IRP Site 18

Enclosure

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